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Editorial Open Access

Anthropogenic Change Regime of Tropospheric Ozone in the Mediterranean and Global Environment

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Editorial

Tropospheric ozone (O_3) is one of the atmospheric pollutants and a key oxidant in photochemical smog, and formation of ground-level O_3 is a photochemically driven process in which nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC_s) react in the atmosphere in the presence of solar radiation [1]. Ozone precursors are mainly released from motor vehicles, industrial activities, and power generation facilities, while vegetative emissions, wildfires, and lightning are considered to be the natural sources of O_3 precursor gases. Surface deposition and reaction with the hydrogen peroxy radical in the troposphere are the two main sinks for ground-level O_3 [2]. Since the formation of O_3 is stimulated with the increased air temperature, O_3 concentrations show a peak once the solar radiation peaks. Daily and diurnal O_3 variations for a cool temperate location (Bolu, Turkey) were depicted in Figure 1. A daytime peak (~35 ppbv) was observed in the early afternoon between 12:00 and 15:00. Similar patterns have been observed for ground-level O_3 in related literature [3]. Since the 1950s, a significant number of studies in related literature have focused on the adverse impacts of ground-level O3 on human health [4], crops [5], forests [6], and materials [7]. O_3 is the third most significant greenhouse gas (GHG) in terms of radiative forcing [8]. Therefore, such international organizations as the World Health Organization (WHO), the United States Environmental Protection Agency (USEPA), and the European Union (EU) have set guidelines for O_3. The daily maximum eight-hour mean O_3 threshold limit is 100 µg m^{-3} by WHO [9] and 0.075 ppm by the USEPA for National Ambient Air Quality Standards [10]. The maximum daily eight-hour mean (120 µg m^{-3}) should not be exceeded for more than 25 days per year so as to be averaged over three consecutive years according to the EU regulations with Directive/2008/50/EC.

The Mediterranean basin is characterized by a strong photochemical activity and adversely affected by the emissions from different regions with a variety of chemical composition and is especially susceptible to air pollution because of the cloud-free atmosphere and elevated solar radiation intensity [11]. According to the IPCC [8], the climate change will be more pronounced in the Mediterranean region than the other parts of the world, and average temperature will increase by 1.4-5.8°C globally, while the difference between current and projected temperature would be at least 3°C for the Mediterranean region. As a result of this sharp rise in the mean annual temperature, a more drastic decrease in precipitation/rainfall is expected for the region [8]. WHO [9] reported that air pollution has become one of its top priorities since about 400,000 Eastern Mediterranean citizens died prematurely due to air pollution in 2012.

The Mediterranean background ground-level O_3 concentrations are the uppermost level in the Europe, and the O_3 concentration in the Central Mediterranean has been revealed to increase by a factor of five during the last century [12]. Gerasopoulos et al. [13] reported a significant decrease in the surface O_3 concentration at a rate of 3.1 % per year based on observations on the Eastern Mediterranean between 1997 and 2004, which is attributed to the decreased O_3 precursor emissions transported in a long range from the Europe. Sicard et al. [14] showed from hourly O_3 data from 214 European background sites between 2000 and 2010 that rural background O_3 concentration is declining as a result of control measures taken, while corresponding urban concentration is still in an increasing trend. According to atmospheric transport model simulations, the enhanced summertime O_3 concentration over the Mediterranean basin is a major contributor to radiative forcing of the climate [15].

Once the fact that O_3 has been transported among the continents over a long range has been realized, O_3 pollution has become a global issue. The IPCC [8] estimated the global average surface O_3 concentrations for 2040, 2060, 2080 and 2100 at 35-48, 38-71, 41-87 and 42-84 ppb, respectively, based on the five of the less conservative emission scenarios. These future global projections have already been exceeded in the Central and Eastern Mediterranean regions, and Lelieveld et al. [11] demonstrated that the Mediterranean basin receives polluted air masses from the Europe and Asia which in turn deteriorates air quality and alters biogeochemical cycles in the region, in particular, over the summer periods. The long range transport of the air pollution to the Mediterranean has an adverse influence not only on the region itself but also further beyond the region. Therefore, urgent international actions are necessary to substantially decrease and mitigate the environmental pressures over the Mediterranean basin and to quantify and predict the anthropogenic change/alteration regime of the mechanistic relationships between the Mediterranean ecosystems and globally changing environment including climate change [16,17].

References

1. 1. Wali MK., Evrendilek F, Fennessy MS (2010) The Environment: Science, Issues and Solutions. CRC Press Taylor & Francis Group, Boca Raton, FL.
2. 2. Isaksen ISA, Berntsen TK, Dalsøren, S.B, Eleftheratos K, Orsolini Y, et al., (2014) Atmospheric ozone and methane in a changing climate. Atmosphere 5:518-535.
3. 3. Zheng J, Zhong L, Wang T, Louie PKK, Li Z (2010) Ground-level ozone in the Pearl River Delta region: analysis of data from a recently established regional air quality monitoring network. Atmos Environ 44:814-823.
4. 4. Kassomenos PA, Dimtriou K, Paschalidou AK (2013) Human health damage caused by particulate matter PM10 and ozone in urban environments: the case of Athens, Greece. Environ Monitor Assess 185: 6933–6942.

5. 5. Gonzalez-Fernandez I, Kaminska A, Dodmani M, Goumenaki E, Quarrie S, et al., (2010) Establishing ozone flux- response relationships for winter wheat: analysis of uncertainties based on data for UK and Polish genotypes. Atmos Environ 44: 621- 630.
6. 6. Gerosa G, Finco A, Mereu S, Vitale M, Manes F, et al., (2009) Comparison of seasonal variations of ozone exposure and fluxes in a Mediterranean Holm oak forest between the exceptionally dry 2003 and the following year. Environ Poll 157: 1737-1744.
7. 7. Hoang C, Nguyen T, Stanley D, Persily A, Corsi RL (2014) Effect of ozonation on fungal resistance of bamboo and oak flooring materials. Building Environ 81: 226-233.
8. 8. IPCC (2001) Climate Change 2001: the Scientific Basis. Report of the Working Group I of the
9. Inter-governmental Panel on Climate Change. IPCC Secretariat, Geneva.
10. 9. WHO (2013) Report of the Regional Committee for the Eastern Mediterranean, Sixtieth Session, Muscat, Oman, 27-30 October, EM/RC60/12-E, February 2014.
11. 10. USEPA, National Ambient Air Quality Standards (NAAQS), (40 CFR part 50).
12. 11. Lelieveld J, Berresheim H, Borrmann S, Crutzen PJ, Dentener FJ, et al., (2002) Global air pollution crossroads over the Mediterranean. Science 298:794-799.
13. 12. Nolle M, Ellul R, Ventura F, Güsten H (2005) A study of historical surface ozone measurements (1884-1900) on the island of Gozo in the central Mediterranean. Atmos Environ 39: 5608-5618.
14. 13. Gerasopoulos E, Kouvarakis G, Vrekoussis M, Kanakidou M, Mihalopoulos N (2005) Ozone variability in the marine boundary layer of the eastern Mediterranean based on 7-year observations. J Geophys Res 110.
15. 14. Sicard P, de Marco A, Troussier F, Renou C, Vas N, et al., (2013) Decrease in surface ozone concentrations at Mediterranean remote sites and increase in the cities. Atmos Environ 79:705-715.
16. 15. Hauglustaine DA, Brasseur GP (2001) Evaluation of tropospheric ozone under anthropogenic activities and associated radiative forcing of climate. J Geophys Res 106: 32337–32360.
17. 16. Aydin M, Yano T, Evrendilek F, Uygur V (2008) Implications of climate change for evaporation from bare soils in a Mediterranean environment. Environ Monior Assess 140: 123-130.
18. 17. Akbolat D, Evrendilek, F, Coskan A, Ekinci K (2009) Quantifying soil respiration in response to short-term tillage practices: a case study in southern Turkey. Acta Agr Scand B-S P 59: 50-56.